

Summary

2001 NASA CELL SCIENCE CONFERENCE - Annual Investigators Working Group Meeting -

March 6-8, 2001
The Warwick
Houston, Texas

*Sponsored by the Cellular Biotechnology Program, NASA Johnson Space Center (JSC),
and the Fundamental Biology Program, NASA Ames Research Center (ARC),
in cooperation with the Physical Sciences Division and the Fundamental Space Biology Division of the Office of
Biological and Physical Research, NASA Headquarters.*

The first Agency-wide Cell Science Conference was held in Houston, Texas March 6-8, 2001. Approximately 200 scientists from universities, medical centers, NASA field centers, the National Institutes of Health (NIH), National Space Biomedical Research Institute (NSBRI), and commercial cell culture enterprises were in attendance. Sponsored by the NASA JSC/Cellular Biotechnology and ARC/Fundamental Biology Programs in an effort to foster coordination and collaboration among these programs, the conference included formal oral presentations, a business meeting, a Plenary Lecture and evening meal, an exhibit area for display of hardware, and an evening Workshop. Presentations by investigators funded through these programs covered both flight and ground-based research. Sixty-one oral presentations were given in sessions covering Biological Response to Physical Forces, Cell Culture Technology, Cell Movement/Cytoskeleton, Models in Lower Organisms, Proliferation and Differentiation, Gene Expression, Tissue Modeling, and Immunology.

Sessions (8), Speakers (61*) and Presentations:

* 65 presentations were scheduled, 4 were not given due to inclement weather canceling airline flights

Biological Response to Physical Forces:

S. Sukharev - Department of Biology, University of Maryland

The Tension-Driven Gating Transition in the Bacterial Mechanosensitive Channel, MscL

Y.-L. Wang - Department of Physiology, University of Massachusetts Medical School

Mechanosensing of Cultured Fibroblasts

F.D. Sack - Department Plant Biology, Ohio State University

Dense Organelles that Sediment in Moss Cells are Distributed Non-Randomly in Microgravity

D.J. Morré - Purdue University

Structural Analyses of a Growth-Related and Graviresponsive Time-Keeping (clock) Protein of the Cell Surface

C.A. Nickerson - Department of Microbiology and Immunology, Tulane University Medical Center

Effect of Microgravity on Bacterial Virulence, Increased Health Risks During Spaceflight?

J. Braam - Biochemistry and Cell Biology, Rice University

Regulation of Plant Gene Expression by Mechanical Force: Analyses Using TCH::Luciferase Fusions

F.J. Alenghat - Departments of Pathology and Surgery, Children's Hospital and Harvard Medical School
Mechanotransduction via Integrins: The Role of Integrins in the Mechanical Stimulation of the cAMP Cascade

Cell Culture Technology:

D.W. Murhammer - Departments of Chemical and Biochemical Engineering, The University of Iowa
Monitoring and Control of Rotating Wall Vessels and Application to the Study of Prostate Cancer

J.M. Belovich - Fenn College of Engineering, Cleveland State University
Cell Retention within an Acoustically Assisted Bioreactor

T. Good - Department of Chemical Engineering, Texas A & M University
The Use of a Rotating Wall Bioreactor to Examine Changes in Neuronal Physiology in Simulated Microgravity

B.C. Towe - Arizona State University
Microdialysis-Based Sensors for NASA Space Biotechnology

G. Spaulding - Clear Lake Medical Foundation
Sensors to Expedite FDA Release Requirements

C.F. Ng - Department of Chemical and Biochemical Engineering, The University of Iowa
CFD (Computational Fluid Dynamics) Mass Transfer Modeling of the HARV Bioreactor

C.E. Helmstetter - Department of Biological Sciences, Florida Institute of Technology
New Cell Culture Technology for Cell Cycle Research

A.S. Jeevarajan - Wyle Life Sciences and Cellular Biotechnology Program, NASA/JSC
Performance of a pH Control System and a Glucose Sensor in Perfused Rotating Wall Bioreactors

Cell Movement/Cytoskeleton:

G.K. Muday - Department of Biology, Wake Forest University
Polar Transport of a Plant Hormone Utilizes the Actin Cytoskeleton and Controls Gravity Directed Embryo Polarity

A. Sundaresan - Wyle Life Sciences, Systems and Services
Locomotion of Human T Lymphocytes in Microgravity Analog Cell Culture

S. Hoffman - Division of Rheumatology, Medical University of South Carolina
Embryonic Cell Migration and Metalloproteinase Activity are Affected by Randomization of the Gravity Vector

B.B. Hashemi - Life Science Research Laboratories, NASA – Johnson Space Center, and National Space Biomedical Research Institute, Baylor College of Medicine
The Role of the Actin Cytoskeleton in Gravity Sensitivity of T-Cell Activation

P. Masson - Laboratory of Genetics, University of Wisconsin
The WVD2 Gene is Involved in the Regulation of Root Waving and Cell Expansion in Arabidopsis Thaliana

Models in Lower Organisms:

H.K. Mahtani - Cellular Biotechnology Program, USRA NASA MSFC

Expression of the Acyl-Coenzyme A: Cholesterol Acyltransferase GFP Fusion Protein in Sf21 Insect Cells

C.J. Orihuela – Department of Microbiology and Immunology, The University of Texas Medical Branch

Streptococcus pneumoniae: Growth and Virulence Potential in Simulated Microgravity

K. O'Connor -Tulane University

Cumulative Shear Effects on Attachment-Independent Cells in Simulated Microgravity

B.H. Pyle - Microbiology Department, Montana State University

Microbes and Microgravity

Proliferation and Differentiation:

R.S. Nowakowski - Dept. of Neuroscience and Cell Biology, UMDNJ-Robert Wood Johnson Medical School
Effects of Gravity on Cell Proliferation in the Developing Cerebral Cortex

R. Richmond - Biotechnology Science Group, NASA Marshall Space Flight Center

Differentiation and Genomic Instability in a Human Mammary Cell Model

A.S. Rajan - Baylor College of Medicine

A Strategy for Islet Cell Expansion Utilizing a Ground-Based Rotating Bioreactor

V. Chopra - Department of Ob-Gyn, UTMB

Change in Properties of Cells 3-D Microgravity Culture Environment

W.E. Kraus - Departments of Medicine, Cell Biology and Biomedical Engineering, Duke University

Effects of Chronic Exposure to Simulated Microgravity on Skeletal Muscle Cell Proliferation and Differentiation

R.K. Globus - Life Sciences, NASA/ARC

Regulation of Osteoblast Survival by the Extracellular Matrix and Gravity

Gene Expression:

W.J. Landis - Department of Biochemistry and Molecular Pathology, Northeastern Ohio Universities College of Medicine

Effects of Gravitational Changes on Gene Expression of Cultured Osteoblasts

W.-S. Hu - Departments of Chemical Engineering and Materials Science, University of Minnesota

Genome-Wide Expression Analysis of Hepatocyte Spheroid Formation

T.G. Hammond - Tulane University/VA Environmental Astrobiology Center and VA Medical Center

STS-106 Flight Results - Effects of Mechanical Culture Conditions on Renal Cell Gene Expression

M. Hughes-Fulford - Lab of Cell Growth, UCSF, NCIRE

Microgravity Causes Inhibition of Gene Induction of Growth Factors, Oncogenes, and COX-2 by Fetal Calf Sera in Osteoblasts: Artificial Gravity Reverses the Changes in the Majority of Genes

M.L. Salmi - Section of Molecular Cell and Developmental Biology, University of Texas
Analysis of Gene Expression During Gravity Directed Polarity Fixation in Ceratopteris Richardii Spores

H. Jo - Georgia Tech/Emory Biomedical engineering Department, GA Tech
Fluid Shear Stress Down-Regulates Caveolin-1 and Caveolin-2 Expression in Bovine Aortic Endothelial Cells (BAEC)

E. Wang - Department of Biochemistry and Molecular Biology, University of Louisville
Changes in Gene Expression in Human Fibroblasts During Space Flight

L.V. McIntire - Department of Bioengineering, Rice University
Identification of Genes Regulated by Shear Stress Using Microarray Technology

J.H. D. Wu - Department of Chemical Engineering, University of Rochester
Circadian Rhythm of Hematopoiesis

R.J.C. McLean - Southwest Texas State University
Transcriptional Profiles of Escherichia Coli Gene Expression in Biofilms

Tissue Modeling:

L.W.K. Chung - Molecular Urology and Therapeutics Program, University of Virginia School of Medicine
Modeling Prostate Cancer Growth and Gene Therapy in a 3-D Prostate Spheroid Culture

W.K. Law - Molecular Urology and Therapeutics Program, University of Virginia School of Medicine
Permanent Phenotypic and Genotypic Changes in Human Bone Stromal Cells Co-Cultured with Human Prostate Cancer Epithelial Cells Under Microgravity-Simulated Conditions

P.W. Zandstra - Institute of Biomaterials and Biomedical Engineering, University of Toronto
A Bioprocess for the Generation of Embryonic Stem Cell Derived Cardiac Myocytes

L.E. Freed - Division of Health Sciences and Technology, Massachusetts Institute of Technology
Microgravity Tissue Engineering: Engineering Functional Tissues

G. Vunjak-Novakovic - HST, Massachusetts Institute of Technology
Microgravity Tissue Engineering: Gene Transfer, Oxygen Transport and Mathematical Modeling

Emily Habisch - School of Chemical Engineering, Cornell University
Formation of 3D Cell/Microparticle Assemblies Under Controlled Conditions

H.H. Vandenburgh - Department of Pathology, Brown University School of Medicine, The Miriam Hospital, and Cell Based Delivery, Inc.
Tissue Engineered Skeletal Muscle

P.J. Duke - University of Texas Health Science Center Dental Branch
A 3-Dimensional Culture System Supports Early Craniofacial Development

W.J. Schwartz - Department of Neurology, University of Massachusetts Medical School
Transplantation of Neural Precursor Cells Cultured in a Rotating Wall Vessel Bioreactor (HARV)

L.R. McCabe - Department of Physiology, Michigan State University
Osteoblast Signaling and Gene Expression is Altered Under 2D, 3D and in the Rotating Cell Culture System (RCCS)

P.I. Leikes - Drexel University

Functional Neuroendocrine Organoids in RWV Bioreactors: Signals, Genes, and Angiogenesis

Immunology:

L. Rutzky - Department of Surgery, The University of Texas Medical School

Effect of Simulated Microgravity Conditions on Mouse Pancreatic Islet Immunogenicity and Morphology

J.M. Jessup - University of Texas Health Science Center

Short Term Simulated Microgravity Culture of Human Colon MIP-101 Cells Increases Gene Expression by cDNA Microarray Analysis with a G2/M Cell Cycle Arrest due to Reduction in PLK1 Expression

K. Jagannadha Sastry - Department of Veterinary Sciences, The University of Texas M.D. Anderson Cancer Center

Analysis of Innate and Acquired Cellular Immune Responses Under Microgravity

C.A. Savary - The University of Texas M. D. Anderson Cancer Center

Characteristics of Human Dendritic Cells Generated in the Rotary Cell Culture System

A.D. Kulkarni - Surgery Department, University of Texas Health Science Center

Dietary Nucleotides Obviate Immune Dysfunction in Simulated Microgravity

W.S. Fitzgerald - NASA/NIH Center for Three Dimensional Tissue Culture, LCMB, NICHD, NIH

Switching From Simulated Microgravity to True Microgravity to Study Immunodeficiency

M.A. Morrow - Department of Biology, SUNY New Paltz

The Effect of Modeled Microgravity on T Cell Activation

M. Alexander - Life Sciences Research Laboratories, NASA JSC

Altered Activation Threshold and Signal Transduction in Human T Cells During Clinorotation

D. Risin - Cellular Biotechnology Program, NASA/JSC

Inhibition of Apoptosis in Peripheral Blood Lymphocytes in Modeled Microgravity Involves Changes in PKC Isoforms

Plenary Lecture:

Joshua Zimmerberg - Chief, Laboratory of Cellular and Molecular Biophysics

Director, NASA/NIH Center for Three-Dimensional Tissue Culture

National Institute of Child Health and Human Development

National Institutes of Health

Life at 33 1/3 rpm, or Developing New Tissue Culture Systems for Studying Pathogenesis

ISS Workshop:

Evening workshop focused on developing requirements for analytical capabilities on the International Space Station. Maintaining the concept of ISS as an orbiting laboratory invokes an ever-renewing capacity for on-orbit analytical instrumentation. The workshop provided an opportunity for the science community to advance their desires for real time analysis of flight experiments. This discussion resulted in identification of several analytical strategies

necessary to maintain an up to date orbiting research laboratory. There was a compelling consensus for photometric based quantitation of analytes, real time assessment of gene expression, and sophisticated microscopic analyses such as confocal microscopy. While many of these technologies are compatible with space flight laboratories, more work and concept development will be necessary to perform the sample acquisition and preparation required for the analyses.

Business Meeting:

The status of both sponsoring programs and upcoming ground and flight research opportunities were discussed.

Exhibitors (8):

JSC Cellular Biotechnology Program Flight Hardware

The JSC Cellular Biotechnology Program Office exhibited flight hardware used to conduct cell science research on the Shuttle.

ARC Life Sciences Ground and Flight Research Facilities

Ames Research Center displayed ground-based facilities providing unique capabilities to support research needs in the area of gravitational biology, as well as those facilities under development for the ISS.

ISLSWG Spaceflight Facilities and Hardware for Cell Culture Research

The International Space Life Sciences Working Group (ISLSWG), founded in 1990 to promote international cooperation toward the common goals of strengthening space research and enhancing knowledge and information exchange, exhibited spaceflight facilities and hardware for cell culture research including cell culture systems, sample preparation and preservation, and imaging and sample analysis equipment.

Payload Systems, Inc.

Located in Cambridge, Massachusetts, Payload Systems, Inc. exhibited the Cell Culture Unit (CCU) being developed for use on the ISS for the NASA Ames Research Center. A ground system based on the CCU perfusion-loop is under development for commercial application.

Space Hardware Optimization Technology, Inc. (SHOT, Inc.)

Located in Greenville, Indiana, SHOT, Inc., an R&D engineering company specializing in development of NASA ground and space flight hardware, provided the cell research community with information about their biotechnology and bioprocessing hardware.

Synthecon, Inc.

Marketing the Rotary Cell Culture System™ for growing human 3-D cells and tissue cultures outside the human body, Synthecon, Inc. is a commercial company located in Houston, Texas.

Celdyne, Inc.

Providing advanced products and services for research in tissue engineering and bio-products recovery, Celdyne, Inc., a commercial company located in Houston, Texas, displayed the Hydrodynamic Focusing Bioreactor.

Society for In Vitro Biology

The Society for In Vitro Biology, founded in 1946 to foster the exchange of knowledge of in vitro biology of cells, tissues and organs from both plant and animals (including humans), displayed membership and journal information.